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Sherrill et al.

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(54) **SELECTIVELY COMPLIANT CLAMP**

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CPC ***B23Q 3/065*** (2013.01); ***B23Q 3/063*** (2013.01); ***B23Q 3/064*** (2013.01); ***B23Q 3/082*** (2013.01); ***B23Q 3/088*** (2013.01); *Y10T 29/49998* (2015.01)

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USPC 294/86.4, 87.2, 87.22, 119.3
See application file for complete search history.

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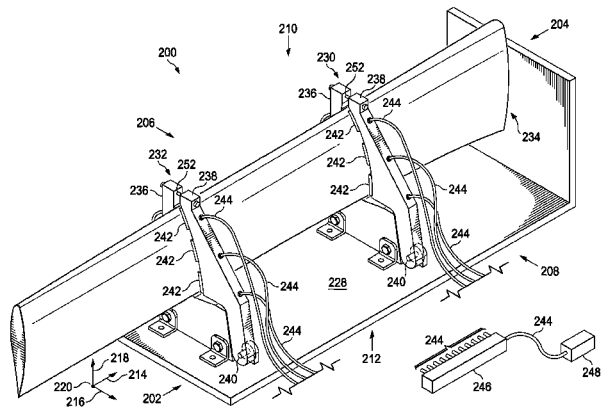
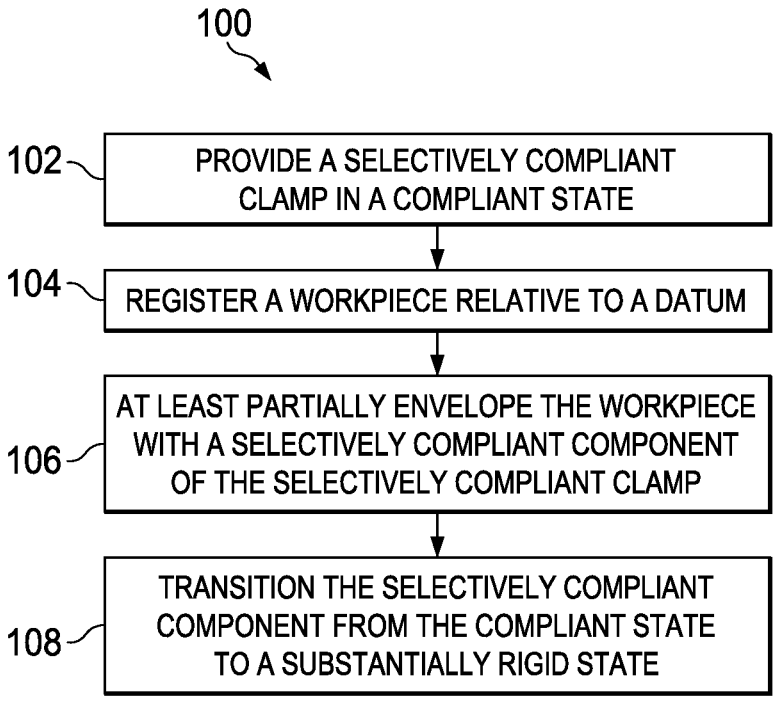
(57) **ABSTRACT**

A clamp has a base and a first selectively compliant component carried by the base, the first selectively compliant component being selectively operable between a substantially compliant state and a substantially rigid state.

29 Claims, 6 Drawing Sheets

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102
PROVIDE A SELECTIVELY COMPLIANT CLAMP IN A COMPLIANT STATE
104
REGISTER A WORKPIECE RELATIVE TO A DATUM
106
AT LEAST PARTIALLY ENVELOPE THE WORKPIECE WITH A SELECTIVELY COMPLIANT COMPONENT OF THE SELECTIVELY COMPLIANT CLAMP
108
TRANSITION THE SELECTIVELY COMPLIANT COMPONENT FROM THE COMPLIANT STATE TO A SUBSTANTIALLY RIGID STATE

FIG. 1

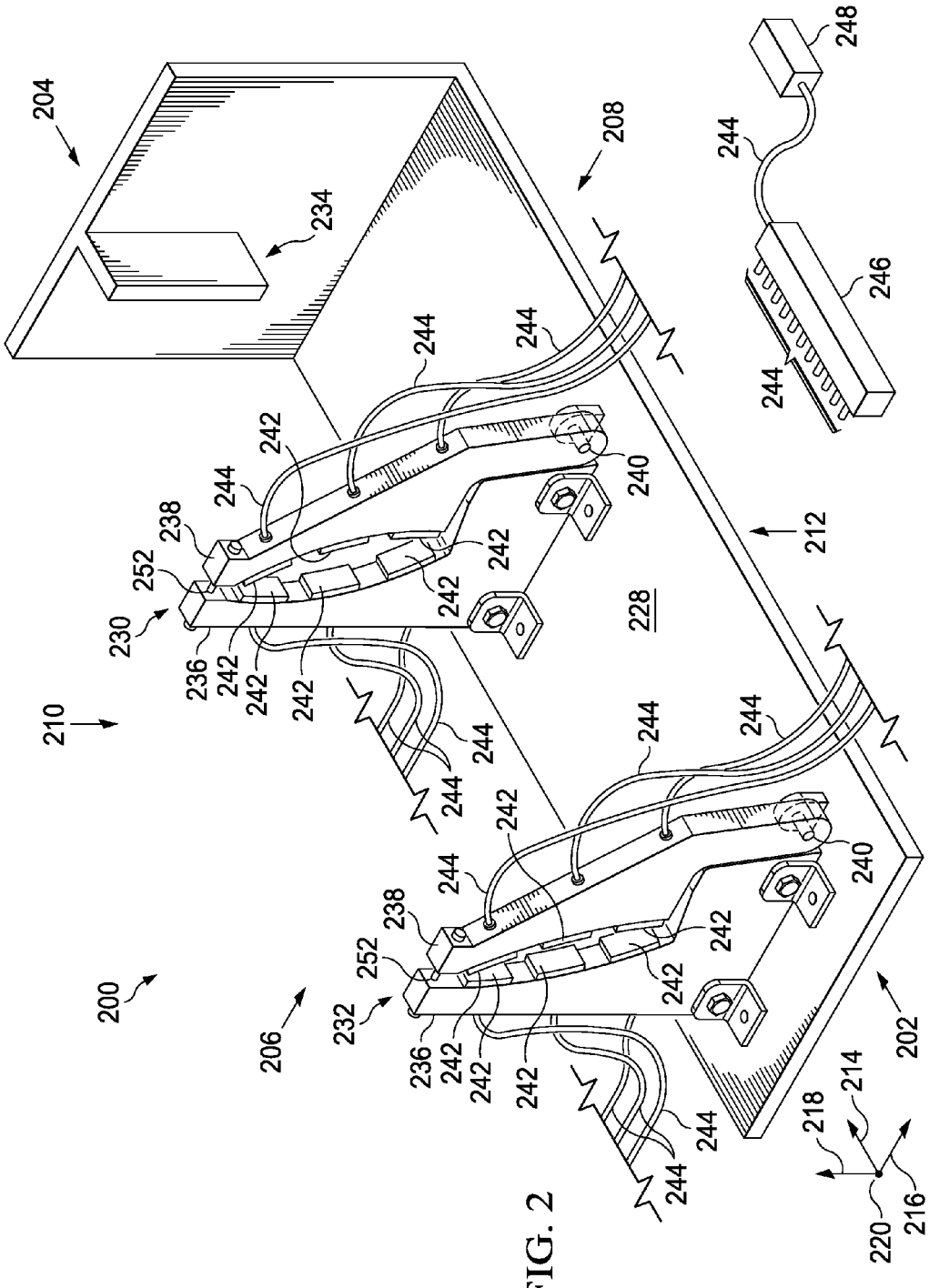
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FIG. 2

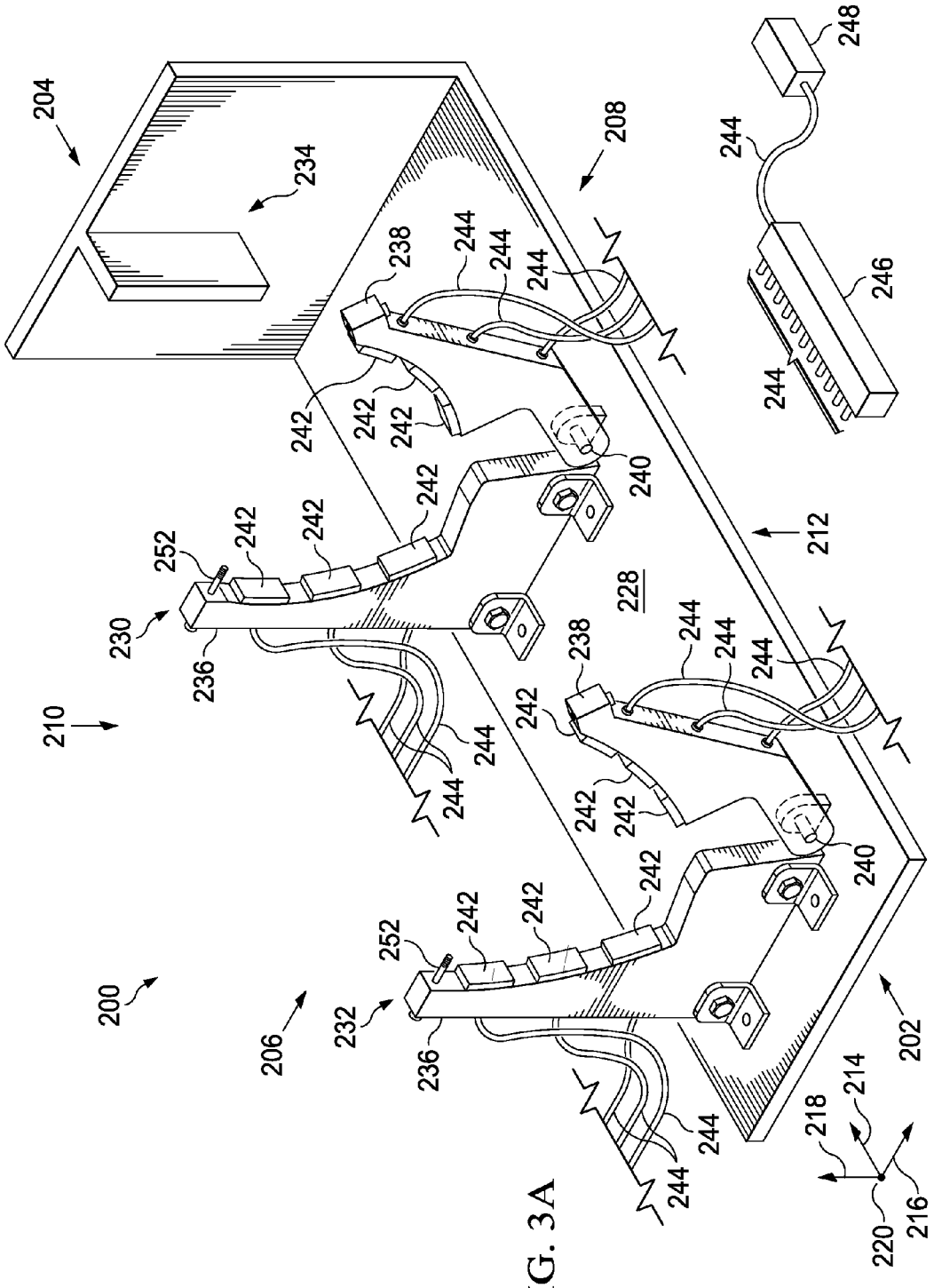
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FIG. 3A

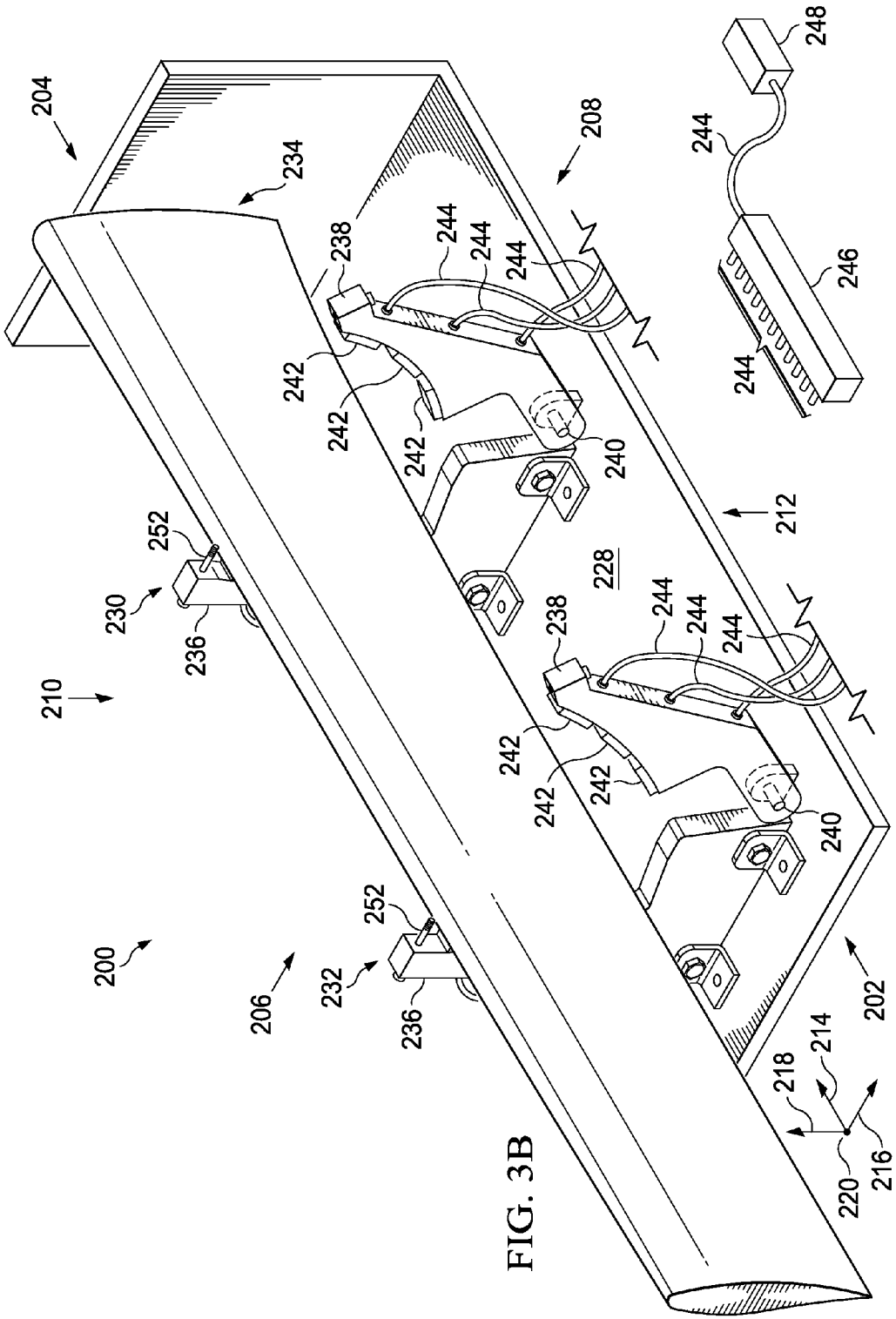
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FIG. 3B

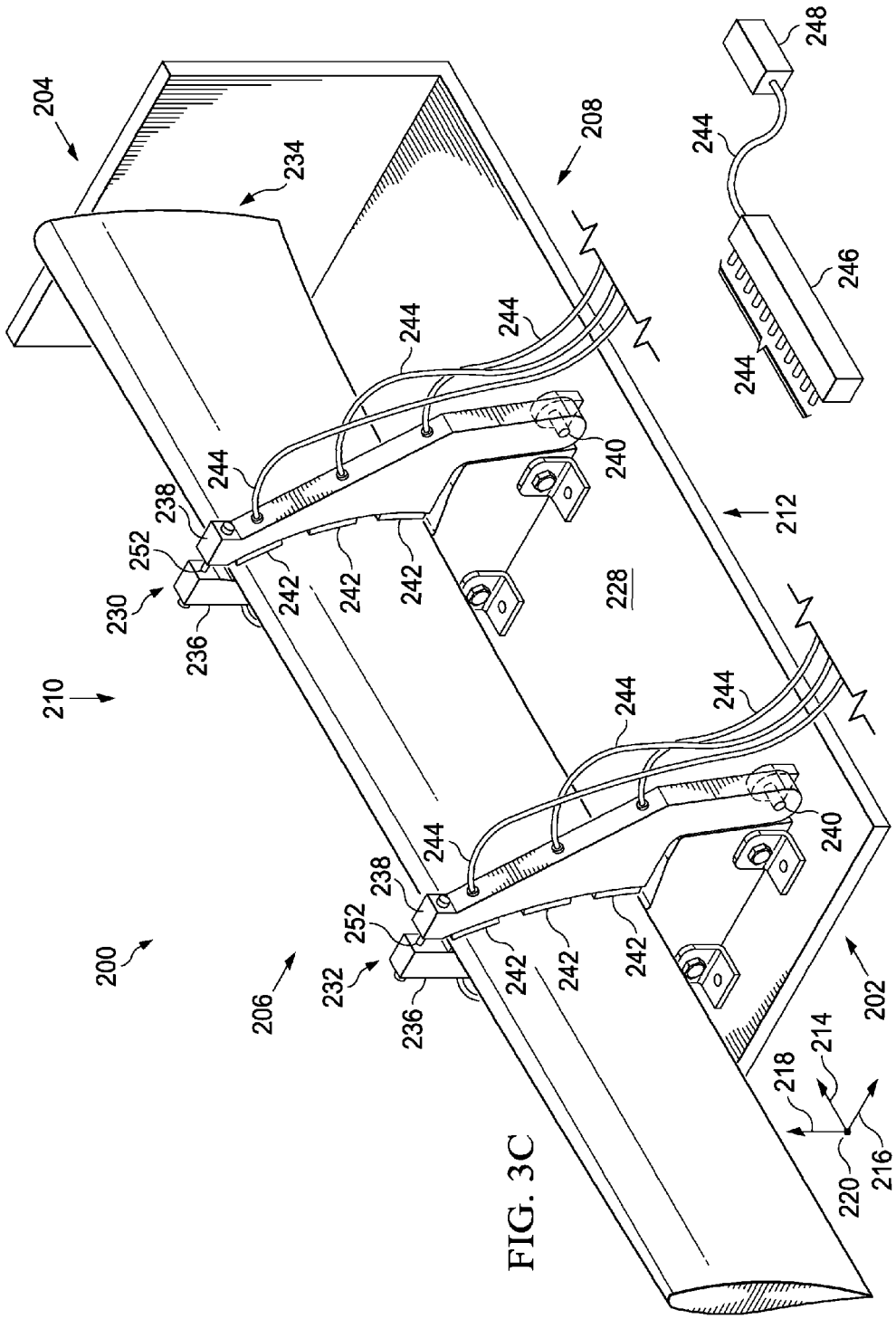
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FIG. 3C

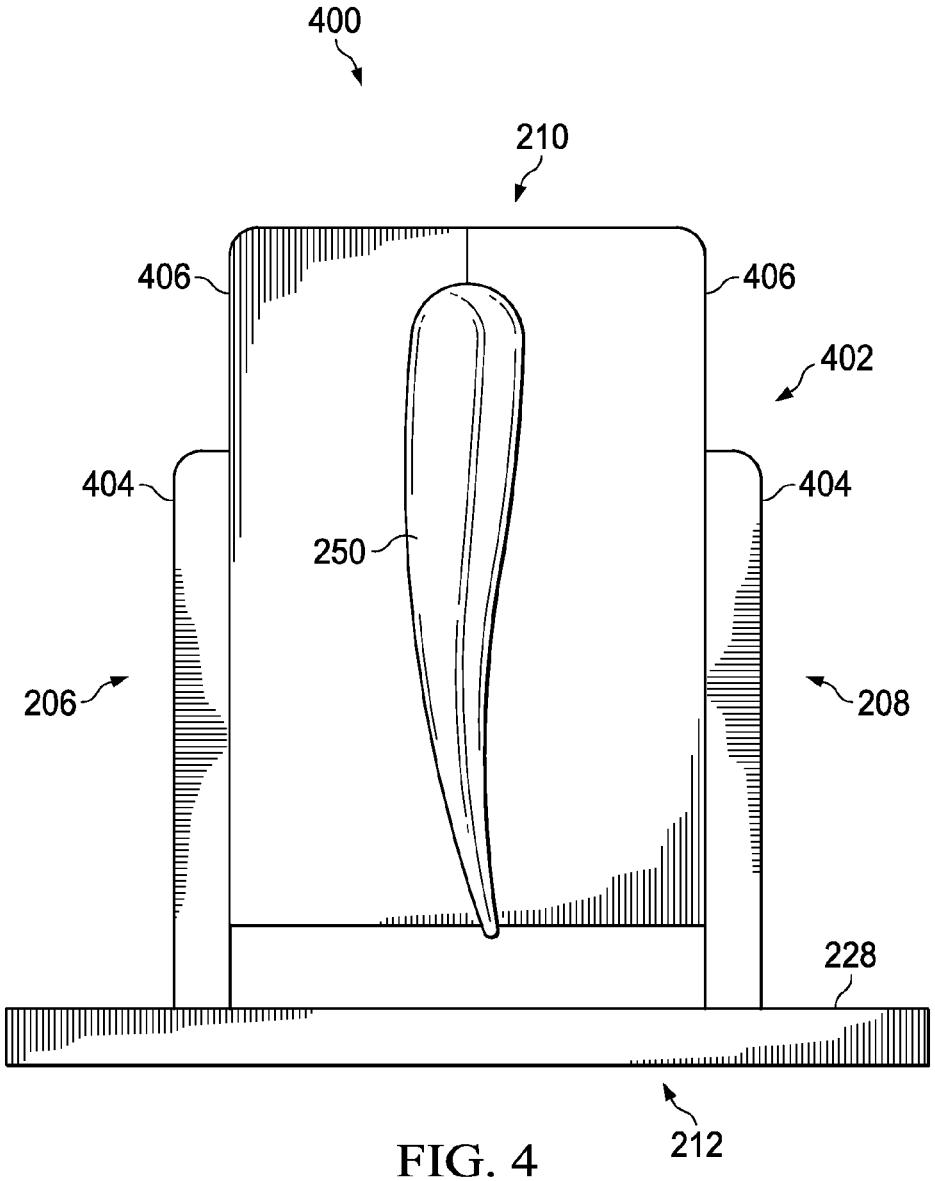

FIG. 4

SELECTIVELY COMPLIANT CLAMP

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

Not applicable.

BACKGROUND

Machining flexible workpieces, such as, but not limited to, composite helicopter rotor components, is complicated by the need to restrain the workpiece with force sufficient to prevent the workpiece from moving, but without deforming the workpiece from a relaxed and/or lowest energy state. In some cases where flexible workpieces are supported and/or spatially restrained by bringing the workpiece into registration with a substantially rigid clamp, such registration and/or abutment may deform the workpiece. Machining a workpiece while deformed from a relaxed state may yield a machined workpiece that fails a tolerance inspection, particularly in parts with tight tolerances, such as aircraft parts. Each substantially rigid clamp comprises a substantially fixed clamping profile and/or clamping shape suitable for clamping only to workpieces with substantially complementary profiles and/or shapes. Accordingly, the ability to machine differently shaped workpieces may require a plurality of clamps configured to specifically complement the variously shaped workpieces.

SUMMARY

In some embodiments of the disclosure, a clamp is disclosed as comprising a base and a first selectively compliant component carried by the base, the first selectively compliant component being selectively operable between a substantially compliant state and a substantially rigid state.

In other embodiments of the disclosure, a workpiece retention system is disclosed as comprising a table, a first selectively compliant clamp connected to the table, and a second selectively compliant clamp connected to the table, wherein each of the first selectively compliant clamp and the second selectively compliant clamp comprise at least one selectively compliant component selectively operable between a substantially compliant state and a substantially rigid state.

In yet other embodiments of the disclosure, a method of restraining a workpiece is disclosed as comprising providing a selectively compliant clamp comprising a selectively compliant component, at least partially enveloping a workpiece with the selectively compliant component, and transitioning the selectively compliant component from a compliant state to a relatively less compliant state.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present disclosure and the advantages thereof, reference is now made to the following brief description, taken in connection with the accompanying drawings and detailed description:

FIG. **1** is a flowchart of a method of restraining a workpiece according to an embodiment of the disclosure;

FIG. **2** is an oblique front-top-right view of a workpiece restraining system according to an embodiment of the disclosure;

FIG. **3**A is an oblique front-top-right view of the workpiece restraining system of FIG. **2** in an open configuration;

FIG. **3**B is an oblique front-top-right view of the workpiece restraining system of FIG. **3**A in a closed configuration with a workpiece registered relative to a datum backstop;

FIG. **3**C is an oblique front-top-right view of the workpiece restraining system of FIG. **2** in locked configuration; and

FIG. **4** is an orthogonal front view of a selectively compliant clamp according to another embodiment of the disclosure.

DETAILED DESCRIPTION

It should be understood at the outset that although an illustrative implementation of one or more embodiments are provided below, the disclosed systems and/or methods may be implemented using any number of techniques, whether currently known or in existence. The disclosure should in no way be limited to the illustrative implementations, drawings, and techniques illustrated below, including the exemplary designs and implementations illustrated and described herein, but may be modified within the scope of the appended claims along with their full scope of equivalents.

In some cases, it may be desirable to provide a clamp that is capable of holding a variety of differently shaped workpieces. In some embodiments of the disclosure, a workpiece retention system is disclosed that comprises a selectively compliant clamp that retains a workpiece without substantially deforming the workpiece while the workpiece is being restrained.

Referring now to FIG. **1**, a workpiece retention system (WRS) may be utilized according to a method **100** of restraining a workpiece. In some embodiments, the workpiece may be flexible. The method **100** may begin at block **102** by providing at least one selectively compliant clamp in a compliant state as shown in FIG. **2**. The method **100** may continue at block **104** by registering a workpiece relative to at least one datum of the WRS. The method **100** may continue at block **106** by at least partially enveloping the workpiece with a selectively compliant component of the selectively compliant clamp as shown in FIGS. **3**C and **4**. The method **100** may continue at block **108** by transitioning the selectively compliant clamp from the compliant state to a substantially rigid state as shown in FIGS. **3**C and **4**. The above-described method **100** may be utilized to generally cause the selectively compliant component of the selectively compliant clamp to selectively reconfigure to comprise a shape that conforms relative to a shape of the workpiece and/or that complements a shape of the workpiece. The above-described transitioning of the selectively compliant component from the compliant state to the substantially rigid state may be accomplished by applying a vacuum pressure to a bladder, altering a supply of electrical energy to a material and/or component that comprises an electrically dependent hardness, and/or any other suitable system of selectively alternating between a relatively pliable component behavior and a relatively rigid component behavior. In some embodiments, the selectively compliant clamp may be used repeatedly in accordance with the method **100** of

restraining a workpiece to selectively restrain workpieces comprising a variety of different shapes utilizing the same WRS.

Referring to FIG. **2**, an oblique front-top-right view of a workpiece retention system (WRS) **200** according to an embodiment of the disclosure is shown. The WRS **200** may generally comprise a front **202**, rear **204**, left **206**, right **208**, top **210**, and bottom **212** and the following description and associated drawings may generally utilize directional indications to assist in identifying the directional orientation of the WRS **200** and/or components of the WRS **200** without the requirement that such an indication is an absolute identification of a directional extent of the WRS **200**. In other words, the above-described directional indications are intended to generally clarify orientations of the components of the WRS **200** relative to each other and to provide context to the associated figures, not to limit the claims. The same directional indicators are utilized in the discussion and associated figures that comprise the WRS **200**, components of the WRS **200**, and/or workpieces associated with the WRS **200** to provide a consistent frame of reference throughout the disclosure.

The WRS **200** further comprises a longitudinal axis **214**, a lateral axis **216**, and a vertical axis **218**. The longitudinal axis **214** generally extends longitudinally in a front-rear direction relative to the WRS **200** and in some embodiments may be associated with a longitudinal direction of the WRS **200** and/or a workpiece associated with the WRS **200**. The lateral axis **216** generally extends laterally in a left-right direction relative to the WRS **200** and in some embodiments may be associated with a lateral direction of the WRS **200** and/or a workpiece associated with the WRS **200**. The vertical axis **218** generally extends vertically in a top-bottom direction relative to the WRS **200**. The longitudinal axis **214**, lateral axis **216**, and vertical axis **218** intersect each other at an origin **220** and may generally be described as defining a three dimensional Cartesian coordinate system. While the axes **214**, **216**, and **218** are generally defined to reflect a specific location of the origin **220** relative to the WRS **200** and the orientation of the axes **214**, **216**, and **218** relative to the WRS **200**, they may be described differently without impact to the functionality of the WRS **200** and/or the components of the WRS **200** disclosed herein. In other words, unless otherwise noted herein, the defined orientations of the axes **214**, **216**, and **218** are provided as a frame of reference against which the WRS **200** and the components of the WRS **200** may be consistently described.

Still referring to FIG. **2**, the WRS **200** comprises a table **228**, a first selectively compliant clamp **230**, a second selectively compliant clamp **232**, and a datum backstop **234**. Each of the first and second selectively compliant clamps **230**, **232** may comprise a base **236** that is attached to the table **228** and a jaw **238** that is movably connected to the base **236** via a hinge **240**. In some embodiments, the bases **236** may be movably mounted relative to the table **228** through the use of slots formed in the table **228** and/or alternative fastener receptacles. In some embodiments, first and/or second selectively compliant clamps **230**, **232** may be rotatable and/or translatable relative to the table **228**. In this embodiment, each of the bases **236** and jaws **238** comprise a plurality of selectively compliant components **242**. In this embodiment, the selectively compliant components **242** may comprise a bag-like bladder comprising loose aggregate material, such as, but not limited to, spherical beads and/or microbubbles, disposed within the bladder. The selectively compliant components **242** may selectively comprise a compliant state in which the selectively compliant components **242** may be malleable, pliable, deformable, soft, shearable, compressible, stretchable, and/or otherwise geometrically reactive to external forces applied to the exterior of the selectively compliant components **242**. The selectively compliant components **242** may selectively comprise a relatively less compliant state and/or a substantially rigid state in which at least one of the above-described malleability, pliability, deformability, softness, shearability, compressibility, stretchiness, and/or geometric reactiveness to external forces applied to the exterior of the selectively compliant components **242** is reduced, lessened, and/or eliminated.

In this embodiment, a selection between the compliant state and the rigid state may comprise selectively applying a vacuum pressure to the interior of the selectively compliant components **242**, namely, the interior of the bladders of the selectively compliant components **242**. In some cases, the vacuum pressure may evacuate air in the bladders and thereby contract the bladder against the aggregate material to lock the aggregate material into place as a substantially rigid and/or behaviorally unitary component. In some cases, the vacuum pressure may be selectively applied to selected ones of the selectively compliant components **242** via vacuum tubes **244** connected to a selection manifold **246** that is configured to selectively allow and/or disallow fluid communication between selected ones of the selectively compliant components **242** and a vacuum pressure source **248**, such as, but not limited to, a vacuum pump.

Referring now to FIG. **3**A, the WRS **200** is shown in an open configuration. In the open configuration, the WRS **200** is provided with the jaws **238** rotated about their respective hinges **240** to move the top of the jaws **238** away from the top of the bases **236**. In the open configuration, the selectively compliant components **242** may be provided in a compliant state. In the open configuration, the WRS **200** may receive a workpiece **250** into the first and second selectively compliant clamps **230**, **232** from above.

Referring now to FIG. **3**B, the WRS **200** is shown in an open configuration with a workpiece **250** received within the first and second selectively compliant clamps **230**, **232**. In some embodiments, the workpiece **250** may be moved rearward and leftward until a flat portion of the workpiece **250** abuts with and/or is otherwise registered and/or spatially maintained in a known location and/or orientation relative to the datum backstop **234** which may comprise both a rearward stop and/or a lateral stop.

Referring now to FIG. **3**C, the WRS **200** is shown in a closed configuration in which the WRS **200** is provided with the jaws **238** rotated about their respective hinges **240** to move the top of the jaws **238** closer to the top of the bases **236**. In the closed configuration, the selectively compliant components **242** may initially be provided in a compliant state to allow the workpiece **250** to be moved into registration with one or more additional datums until the workpiece **250** is in a predetermined and/or desired position relative to a set of datums. Further, with the tops of the bases **236** and jaws **238** adjacent each other, clamp fasteners **252** may be used to join the top of the bases **236** to their respective associated jaws **238** thereby substantially capturing the workpiece **250** in the WRS **200**. When the workpiece **250** is properly registered relative to a set of datums or is otherwise in a desired location and/or orientation, the selectively compliant components **242** of the first and second selectively compliant clamps **230**, **232** may be transitioned from the compliant state to the rigid state rendering the WRS **200** in a locked configuration where a spatial orientation and/or location of the workpiece **250** is kept by the first and second

selectively compliant clamps **230**, **232**. In some embodiments, machining of the workpiece **250** may occur when the WRS **200** is in a locked state. After machining and/or other workpiece **250** related tasks are completed, the WRS **200** may be unlocked and returned to the closed configuration by discontinuing the rigid state of the selectively compliant components **242**. Similarly, the WRS **200** may further be returned to the open configuration by removing the clamp fasteners **252** and rotating the tops of the jaws **238** away from the tops of the bases **236**.

Referring now to FIG. **4**, an orthogonal front view of another WRS **400** comprising a selectively compliant clamp **402** according to an alternative embodiment of the disclosure is shown. The selectively compliant clamp **402** generally comprises two opposing bases **404** that carry opposing selectively compliant components **406**. In this embodiment, the bases **404** may move toward and away from each other and may be connected to a table **228**. In this embodiment, the overall size and/or shape of the selectively compliant components **406** may be so large relative to a workpiece **250** that each base **404** may carry only a single or multiple large selectively compliant components **406**. In operation, the bases **404** may be moved away from each other to allow a workpiece **250** to be placed between opposing selectively compliant components **406**. With the selectively compliant components **406** in a compliant state, the bases **404** may be moved toward each other until the selectively compliant components **406** substantially envelope the workpiece **250** and the bases **404** may be secured relative to the table **228**. When the workpiece is oriented and/or located in a desired and/or predetermined manner, the selectively compliant components **406** may be transitioned to the rigid state in which the selectively compliant components **406** restrain the workpiece **250**.

In some cases, the above-described selectively compliant components **242**, **406** are different from rubber pads of conventional clamps because the rubber pads are generally utilized for providing a relatively soft interface between a workpiece and a relatively hard clamp portion that is shaped to complement the workpiece. This disclosure contemplates that a selectively compliant clamp may comprise one or more large bladders and/or one or more small bladders. This disclosure provides selectively compliant clamps that may be used for differently shaped workpieces. In some embodiments, a bladder may comprise silicone. In some embodiments, a bladder may comprise a relatively high coefficient of friction. In some cases, a selectively compliant clamp may comprise selectively compliant components that are transitioned between a substantially compliant state and a substantially rigid state in response to changes in temperature of the selectively compliant components. In some embodiments, the above-described workpieces may comprise an aircraft component, such as a rotor blade. In some embodiments, a selectively compliant component may comprise piezoelectric components and/or materials configured to provide the above-described substantially compliant state and/or the substantially rigid state in response to changes in electricity applied to the piezoelectric components. In some embodiments, the substantially compliant state of a selectively compliant clamp and/or selectively compliant component may be defined as being flexible and able to deform to a shape of a workpiece without substantially deforming the workpiece.

At least one embodiment is disclosed and variations, combinations, and/or modifications of the embodiment(s) and/or features of the embodiment(s) made by a person having ordinary skill in the art are within the scope of the disclosure. Alternative embodiments that result from combining, integrating, and/or omitting features of the embodiment(s) are also within the scope of the disclosure. Where numerical ranges or limitations are expressly stated, such express ranges or limitations should be understood to include iterative ranges or limitations of like magnitude falling within the expressly stated ranges or limitations (e.g., from about 1 to about 10 includes, 2, 3, 4, etc.; greater than 0.10 includes 0.11, 0.12, 0.13, etc.). For example, whenever a numerical range with a lower limit, R_l, and an upper limit, R_u, is disclosed, any number falling within the range is specifically disclosed. In particular, the following numbers within the range are specifically disclosed: $R=R_l+k*(R_u-R_l)$, wherein k is a variable ranging from 1 percent to 100 percent with a 1 percent increment, i.e., k is 1 percent, 2 percent, 3 percent, 4 percent, 5 percent, . . . , 50 percent, 51 percent, 52 percent, . . . , 95 percent, 96 percent, 97 percent, 98 percent, 99 percent, or 100 percent. Unless otherwise stated, the term "about" shall mean plus or minus 10 percent of the subsequent value. Moreover, any numerical range defined by two R numbers as defined in the above is also specifically disclosed. Use of the term "optionally" with respect to any element of a claim means that the element is required, or alternatively, the element is not required, both alternatives being within the scope of the claim. Use of broader terms such as comprises, includes, and having should be understood to provide support for narrower terms such as consisting of, consisting essentially of, and comprised substantially of. Accordingly, the scope of protection is not limited by the description set out above but is defined by the claims that follow, that scope including all equivalents of the subject matter of the claims. Each and every claim is incorporated as further disclosure into the specification and the claims are embodiment(s) of the present invention.

What is claimed is:

1. A clamp to retain an aircraft component, the clamp comprising:

a base comprising a curved portion shaped to complement a curvature of the aircraft component, the base being attached to a table;

a datum backstop attached to the table and positioned longitudinally rearward of the base, wherein the base is registered relative to a datum on the datum backstop, the datum backstop configured to abut a rearward end portion of the aircraft component; and

a first selectively compliant component carried by the base, the first selectively compliant component being selectively operable between a substantially compliant state and a substantially rigid state;

wherein when the selectively compliant component is operated in the substantially compliant state, the selectively compliant component is configured to selectively assume a first profile in response to forces being applied to an exterior surface of the selectively compliant component while the selectively compliant component selectively opposes the forces being applied to the exterior surface of the selectively compliant component with reactionary forces;

wherein when the selectively compliant component is operated in the substantially rigid state, the selectively compliant component is configured to selectively maintain the first profile;

wherein the selectively compliant component is configured to selectively return to the substantially compliant state; and

wherein the selectively compliant component is configured to transition between the substantially compliant state and the substantially rigid state without substantially altering the reactionary forces.

2. The clamp of claim **1**, wherein the first selectively compliant component is configured to transition between the substantially compliant state and the substantially rigid state in response to an electrical supply supplied to the first selectively compliant component.

3. The clamp of claim **1**, wherein the selectively compliant component carried by the base substantially envelops a side profile of the aircraft component.

4. The clamp of claim **1**, wherein the aircraft component comprises a rotor blade, and wherein the curved portion of the base is shaped to complement the curvature of the rotor blade.

5. The clamp of claim **1**, wherein the selectively compliant component is a first selectively compliant component, and wherein the clamp further comprises a plurality of selectively compliant components carried by the base and including the first selectively compliant component, the plurality of selectively compliant components being selectively operable between a substantially compliant state and a substantially rigid state.

6. The clamp of claim **5**, wherein the at least one selectively compliant component of the plurality of selectively compliant components is shaped differently from another selectively compliant component of the plurality of selectively compliant components.

7. The clamp of claim **1**, further comprising:

a jaw configured to rotate about a hinge between an open configuration to receive the aircraft component and a closed configuration to retain the aircraft component between the base and the jaw; and the hinge rotatably connecting the jaw to the base at a first end of the jaw.

8. The clamp of claim **7**, further comprising a second selectively compliant component carried by the jaw, the second selectively compliant component being selectively operable between a substantially compliant state and a substantially rigid state.

9. The clamp of claim **7**, further comprising a fastener connected to each of the base and the jaw at a second end of the jaw opposite the hinge, the fastener configured to selectively connect the jaw to the base at the second end of the jaw opposite the hinge, wherein when the fastener rigidly connects the jaw to the base at the second end of the jaw, the fastener at least partially restrains the jaw from moving relative to the base and the aircraft component is at least partially captured between the base and the jaw.

10. The clamp of claim **1**, wherein the first selectively compliant component comprises a bladder.

11. The clamp of claim **10**, wherein the selectively compliant component comprises an aggregate material disposed within the bladder.

12. The clamp of claim **11**, wherein the aggregate material comprises spherical beads.

13. The clamp of claim **12**, further comprising a vacuum hose connected to the bladder.

14. A workpiece retention system to retain an aircraft component, comprising:

a table;

a first selectively compliant clamp connected to the table and comprising a first curved portion shaped to complement a curvature of the aircraft component;

a second selectively compliant clamp connected to the table and comprising a second curved portion shaped to complement the curvature of the aircraft component; and

a datum backstop connected to the table and positioned longitudinally rearward the first selectively compliant clamp and the second selectively compliant clamp, wherein at least one of the first selectively compliant clamp or the second selectively compliant clamp are registered relative to a datum on the datum backstop, the datum backstop configured to abut a rearward end portion of the aircraft component;

wherein at least one of the first selectively compliant clamp and the second selectively compliant clamp comprise a selectively compliant component selectively operable between a substantially compliant state and a substantially rigid state;

wherein when the selectively compliant component is operated in the substantially compliant state, the selectively compliant component is configured to selectively assume a first profile in response to forces being applied to an exterior surface of the selectively compliant component while the selectively compliant component selectively opposes the forces being applied to the exterior surface of the selectively compliant component with reactionary forces;

wherein when the selectively compliant component is operated in the substantially rigid state, the selectively compliant component is configured to selectively maintain the first profile;

wherein the selectively compliant component is configured to selectively return to the substantially compliant state; and

wherein the selectively compliant component is configured to transition between the substantially compliant state and the substantially rigid state without substantially altering the reactionary forces.

15. The workpiece retention system of claim **14**, wherein the selectively compliant component is configured to transition between the substantially compliant state and the substantially rigid state in response to an electrical supply.

16. The workpiece retention system of claim **14**, wherein at least one of the first selectively compliant clamp and the second selectively compliant clamp comprise a bladder comprising spherical beads disposed within the bladder.

17. The workpiece retention system of claim **14**, wherein at least one of the first selectively compliant clamp and the second selectively compliant clamp comprise a pair of opposing selectively compliant components.

18. The workpiece retention system of claim **14**, wherein the first selectively compliant clamp comprises:

a first base, the first base comprising the first curved portion;

a first jaw configured to rotate about a first hinge between an open configuration to receive the aircraft component and a closed configuration to retain the aircraft component between the first base and the first jaw; and

the first hinge rotatably connecting the first jaw to the first base at a first end of the first jaw; and

wherein the second selectively compliant clamp comprises:

a second base, the second base comprising the second curved portion;

a second jaw configured to rotate about a second hinge between an open configuration to receive the aircraft component and a closed configuration to retain the aircraft component between the first base and the first jaw; and

the second hinge rotatably connecting the second jaw to the second base at a first end of the second jaw.

19. The workpiece retention system of claim **14**, further comprising a vacuum source selectively connected to the selectively compliant component.

20. The workpiece retention system of claim **19**, wherein at least one of the first selectively compliant clamp and the second selectively compliant clamp are configured to receive the aircraft component, the aircraft component comprising a flexible component of a helicopter rotor system.

21. A method of restraining an aircraft component, comprising:

providing a selectively compliant clamp comprising:

a base comprising a curved portion shaped to complement a curvature of the aircraft component, the base being attached to a table;

a jaw;

a hinge rotatably connecting the jaw to the base at a first end of the jaw, wherein the jaw is configured to rotate about the hinge between an open configuration and a closed configuration;

a datum backstop attached to the table and positioned longitudinally rearward of the base; and

a selectively compliant component carried by the base, the selectively compliant component being selectively operable between a substantially compliant state and a substantially rigid state;

registering the base relative to a datum on the datum backstop;

abutting a rearward end portion of the aircraft component against the datum backstop;

at least partially enveloping the aircraft component with the selectively compliant component between the base and the jaw; and

without substantially altering forces applied to the aircraft component from the selectively compliant component, transitioning the selectively compliant component from a compliant state to a relatively less compliant state;

wherein when the selectively compliant component is operated in the compliant state, the selectively compliant component is configured to selectively assume a first profile in response to force being applied to an exterior surface of the selectively compliant component by the aircraft component;

wherein when the selectively compliant component is operated in the relatively less compliant state, the selectively compliant component is configured to selectively maintain the first profile; and

wherein the selectively compliant component is configured to selectively return to the compliant state.

22. The method of claim **21**, wherein enveloping the aircraft component comprises pressing the selectively compliant component against the aircraft component to deform the selectively compliant component without substantially deforming the aircraft component.

23. The method of claim **21**, wherein the selectively compliant component comprises a bladder containing a plurality of spheres and is configured to interface with the aircraft component, and wherein the transitioning the selectively compliant component from the compliant state to the relatively less compliant state comprises altering a pressure within the bladder.

24. The method of claim **21**, wherein the transitioning the selectively compliant component from the compliant state to the relatively less compliant state comprises altering an electrical supply to the selectively compliant component.

25. The method of claim **21**, further comprising, with the jaw in the closed configuration, rigidly fastening the base of the selectively compliant clamp to the jaw of the selectively compliant clamp with a fastener connected to the base and the jaw at a second, opposite end of the jaw, wherein the jaw is pivotally attached to the base at the hinge at the first end of the jaw.

26. The method of claim **21**, further comprising machining the aircraft component.

27. The method of claim **21**, wherein the relatively less compliant state comprises a substantially rigid state.

28. The method of claim **21**, wherein the aircraft component comprises a rotor blade.

29. The method of claim **21**, wherein at least partially enveloping the aircraft component with the selectively compliant component between the base and the jaw comprises:

with the jaw in the open configuration, placing the aircraft component between the base and the jaw of the selectively compliant clamp; and

rotating the jaw about the hinge to the closed configuration to retain the aircraft component between the base and the jaw of the selectively compliant clamp.

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